

PUBLIC HEALTH ACT,

(11 & 12 Vict., Cap. 63.)

REPORT

TO THE

GENERAL BOARD OF HEALTH,

ON A

PRELIMINARY INQUIRY

INTO THE SEWERAGE, DRAINAGE, AND SUPPLY OF
WATER, AND THE SANITARY CONDITION
OF THE INHABITANTS

OF THE TOWN OF

WHITSTABLE.

BY THOMAS WEBSTER RAMMELL,

SUPERINTENDING INSPECTOR.



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1849.

NOTIFICATION.

THE General Board of Health hereby give notice, in terms of section 9th of the Public Health Act, that on or before the 20th June, written statements may be forwarded to the Board with respect to any matter contained in or omitted from the accompanying Report on the Sewerage, Drainage, and Supply of Water, and the Sanitary Condition of the Inhabitants of the Town of WHITSTABLE, or with respect to any amendment to be proposed therein.

By order of the Board,
HENRY AUSTIN, *Secretary.*

Gwydyr House, Whitehall,
14th May, 1849.

PUBLIC HEALTH ACT (11 and 12 Vict., cap. 63).

Report to the General Board of Health on a Preliminary Inquiry into the Sewerage, Drainage, and Supply of Water, and the Sanitary Condition of the Inhabitants of the Town of WHITSTABLE. By THOMAS WEBSTER RAMMELL, Superintending Inspector.

MY LORDS AND SIR,

*Gwydyr House, Whitehall,
May 1, 1849.*

I HAVE the honour to inform you that, in accordance with your directions, I have visited the town of Whitstable, in the county of Kent.

Having caused the requisite notices to be issued for a meeting on the 18th of January last, I commenced on that day, at the "Bear and Key" inn in the town, a public inquiry with respect to the matters mentioned in my instructions, and set forth in the published notices.

I continued the inquiry throughout the two following days, the 19th and 20th January, and, during the course of it, the following witnesses appeared before me, and were examined:—

1. Robert Tritton Whorlow, postmaster, and assessor for Whitstable and Seasalter.
2. William Hyder, gentleman.
3. William Gand, master mariner.
4. Henry Holden, grocer.
5. Samuel Hodges, smith.
6. James Smith, shoemaker, and sexton of Whitstable parish.
7. William Knight, draper.
8. John Auld, schoolmaster.
9. William Beer, farmer, surveyor of highways for Whitstable.
10. John Marshall, retired officer.
11. Widow Beale.
12. James Edward Mitchell Williams, surgeon, registrar for the district.

I also, accompanied by the greater number of the persons who attended the meeting, perambulated the town, and examined the site, the construction of the buildings, the state of the streets and open spaces, the works for surface and refuse drainage and

those for the supply of water, and, at the same time, I carefully observed the appearance and condition of the inhabitants generally.

I further, on these and subsequent days, examined a considerable breadth of the country lying around the town.

From information thus acquired, I have prepared the following report, which I have divided into two parts; in the first part, I have attempted to set forth the present condition of the town, in regard to the matters embraced by the inquiry; in the second, the nature of some of the measures and works which I recommend for its improvement.

I have the honour, &c.,

T. W. RAMMELL.

FIRST PART.

The town of Whitstable is situate upon the sea-shore, in the northern part of the county of Kent. The general direction of this line of coast is east and west, but it here makes a bend to the south-west, and thus gives to the town a north-western aspect. Opposite, but inclined towards the west, and at a distance of rather more than three miles, is the Isle of Sheppey. Between the island and the town, at low water, a large extent of soft muddy shore, called the Whitstable flats, is exposed to view, and the two lands are then only divided by the deep entrance of the Swale; a channel which is navigable at all times of the tide for a considerable distance inland. Whitstable is six miles and a half distant from Canterbury, and it may be regarded as the port of that city. Until 1825, the traffic between the two places was mainly carried on upon a turnpike-road, but, in that year, an Act was obtained for the formation of a railway between them, and for enlarging the harbour of Whitstable. This line was shortly afterwards completed, and the harbour enlarged, so as to be capable of accommodating from fifteen to twenty vessels each of 200 tons burthen.

The whole of the works, both of the railway and harbour, are now leased to the South-Eastern Railway Company, who have effected a junction between this and their own line at Canterbury, and thus established a continuous, although circuitous, railway communication between Whitstable and London.

The geological position of the town is at the edge of the London basin, upon the London clay. At the distance of a few miles southward and eastward, the lower division of this bed, the plastic clay, makes its appearance, and the chalk crops out at the distance of from seven to eight miles in each of those directions.

The dip of the London clay here appears to be nearly north-north-west.

The town is placed in the midst of a flat, which extends for about half a mile on either side the buildings, where it assumes a

marshy character, and is intersected with ditches; at a short distance rearward the ground becomes undulating, and gradually rises to a general elevation of about 100 feet.

The water-shed line of this higher land is thrown forward to the right and left, and, abutting upon the sea, encloses a nearly semicircular area, about 700 acres in extent, having the town in the centre; and in the middle it recedes, and includes a second area about 180 acres in extent, irregular in form, and more elevated than the first, into which it drains between the hills, immediately behind the town.

A correct idea of the extent of the natural drainage area will be at once obtained by reference to the accompanying plan, upon which the hills are shaded.

Beyond this double area, eastward and southward, the country is hilly and undulating; in parts covered with extensive woods, in others under cultivation as arable and meadow land; the whole being thinly populated.

To the west, the ground spreads out into a wide extent of wet and ill-drained marshes; a cold and aguish district, with scarcely a house upon it.

One small stream threads its way between the hills at the back of the town, crosses the flat, and discharges its waters into the harbour; and though in ordinary states of the weather its volume is most insignificant, after sudden and heavy rain it swells and becomes formidable.

No other water flows into the valley of the town excepting that falling within the water-shed line of the hills, and brought down by the various water-courses.

The tide at the springs rises about 16 feet, and the surface of the flat constituting the site of the town is then below the level of high water.

A wall, or bank, about 6 feet high, has been formed along the shore, to protect the town from the encroachments of the sea, and a cross wall extends through part of the town inland, which served the same purpose when the sea covered the western marshes, from which it was only excluded about 60 years since.

The nature of the soil, both of the flat and of the upland, and also of a large breadth of surrounding country, is a stiff and adhesive clay, almost impermeable to, but extremely retentive of, moisture. The condition of this clay varies much with the state of the atmosphere and the amount of the rainfall; during winter, and at all times after heavy rains, it becomes a stiff and close paste, extremely difficult to work, while the heat of a dry summer causes it to open in cracks wide enough to admit a man's leg. I am informed that, after very heavy and continuous rains, the swelling of the soil is so great as to stop completely the action of the agricultural drains, which is not afterwards recovered until a dry summer has again opened the ground. This character

however applies more to the soil of the uplands, which is a clay of a reddish hue, than to that of the lower portion of the district, which in parts is of the nature of elite, and of a blue colour.

The powers of this soil for vegetable production vary a good deal in the district comprised within the two parishes; in some parts they are by no means great, but generally, and particularly on the lower levels, in favourable seasons, they are capable of producing extremely rich crops of grain. The wheat grown here is said to be of exceedingly fine quality.

The soil appears also to be well adapted for the growth of timber; and, indeed, until a not very distant period, the large Forest of Blean extended over the whole of the uplands of this district.

The land is now divided into farms, varying from 100 to 500 acres in extent, and which are let at rentals varying from 30s. to 40s. per acre.

The marsh land is usually let at about 25s. per acre, excepting in the immediate vicinity of the town, where, as accommodation land, it fetches about 30s. per acre.

The bricks and tiles made from the clay are not of very excellent quality; but this may be due, in a great measure, to the imperfections of the mode of manufacture.

The prevailing winds blow from the south-west, and from these, which are invariably mild, the town is, as it were, sheltered, while it lies completely open and exposed to the north and north-east winds, which, during the winter, and late in the spring, are extremely cold and cutting, and frequently cause great injury to vegetation upon this coast.

Thick fogs are very frequent, and even during the summer months, at morning and evening, there is always a mist upon the marshes.

I have not been able to ascertain the amount of the rain-fall, but it cannot differ materially from that observed at Greenwich.

BUILDINGS AND WORKS.—A large portion of the buildings of the town are placed on either side the turnpike-road connecting Whitstable with Canterbury, which, continued for about three-quarters of a mile to the sea, constitutes the main street, and is called Whitstable-street. The mass of the town is near the sea, where the buildings spread out to the right and to the left along the shore. There is a detached part, consisting of about 20 houses, clustered round the old parish church of Whitstable, and called Church-street, towards the south-east, at a distance of about half-a-mile; and there are also a few detached houses, both eastward and westward, along the sea-shore.

The materials chiefly made use of in the construction of the houses are brick and wood, the former being commonly employed for the foundations and external walls, and the latter for the roofs,

floors, and partitions; the greater number of the older houses, however, and also many of those recently erected, are built (excepting the foundations) entirely of wood. The brick used is by no means excellent, being soft and extremely porous, so that upon this wet soil where it is almost constantly saturated with moisture, the houses built with it are uniformly, in the lower rooms, damp and chilly. I am informed that the wooden houses are much preferred by the occupiers, on account of their greater freedom from damp and the increased warmth they afford.

None of the houses are of very ancient date, and the greater number have been built within the last 30 years. The town is now rapidly extending.

The works of the harbour are of considerable magnitude, as compared with the size of the town; and a further extension of them is contemplated in the reconstruction of one of the piers, which has lately given way.

Near the harbour, the South Eastern Railway Company have recently erected extensive coking ovens, from which the locomotive engines on the Canterbury branch of their line are supplied.

The church of Whitstable parish, in Church-street, is an ancient structure, having a burying-ground around it; that of Seasalter parish, placed in the middle of the town, is a modern erection; to the latter the buildings of the National schools are attached.

STATISTICS.—The area of the parish of Whitstable is 3,460 acres.

The area of the parish of Seasalter is 1450 acres.

By a glance at the plan it will be perceived that the boundary line between the two parishes takes a zigzag course through the midst of the houses, and divides the town into two parts.

The assessor of both parishes (Mr. Whorlow) states the numbers of the houses in the town to be as follows:—

Houses in Whitstable Parish	411
Houses in Seasalter Parish	194
	<hr/>
Total of houses in the town	605
	<hr/>

The following list exhibits in gradations the rateable value of the house property, which is taken at the full amount of its real value:—

Houses in the town of Whitstable rated to the relief of the poor—

Annual rent not exceeding 5 <i>l</i>	76
Above 5 <i>l</i> . „ 10 <i>l</i>	421
Above 10 <i>l</i> . „ 15 <i>l</i>	57
Above 15 <i>l</i> . „ 20 <i>l</i>	29
Above 20 <i>l</i> . „ 30 <i>l</i>	22
	<hr/>
Total of houses	605

In this list the large preponderance of houses above 5*l.* and not exceeding 10*l.* yearly rent, amounting to 69·5 per cent. of the whole number, will be observed.

The total annual rental of the house property amounts to about 6000*l.*, and upon this estimate the average rental of each house will be 9*l.* 18*s.* 4*d.*

According to the two last censuses, the population of the parishes of Whitstable and Seasalter was—

	In 1831.	In 1841.
	Individuals.	Individuals.
Whitstable . .	1,926	2,255
Seasalter . .	945	1,064
	2,871	3,319

Showing an increase in the ten years of 448 individuals, being at the average rate of 1·56 per cent. per annum.

Mr. Whorlow estimates the present population of the town alone at—

2100 individuals in Whitstable Parish.

1150 individuals in Seasalter Parish.

3250 total estimated present population of the town.

Being only 69 individuals below the entire population of the two parishes in 1841.

This estimate gives the average of 5·2 individuals to each house in the town.

GOVERNMENT.—The parishes of Whitstable and Seasalter are both comprised within the district of the Blean Union.

The former parish is represented at the Board of Guardians by two Guardians, one of whom does not reside within the parish, and has no connexion whatever with the town; while the other is resident within the parish, but at the distance of a mile and a-half from the town.

The parish of Seasalter, as I am informed, is now, and has been for some time past, altogether unrepresented at the Board of Guardians.

The resident Guardian of the parish of Whitstable is the surveyor of highways of the parish of Seasalter. The highways of the parish of Whitstable are superintended by a paid officer, resident in the country, and receiving a salary of 15*l.* per annum.

The jurisdiction of the Commissioners of Sewers for the eastern division of the county of Kent, extends over this district.

There is no local Act of Parliament in force within these parishes, for any of the purposes of the Public Health Act, and no powers for conducting the affairs of the town, other than those which apply to the rural districts generally.



Note. The red line denotes the Boundary of the proposed new District.

Scale 4-Inches to One Mile.



TRADE.—The inhabitants of the town are chiefly engaged in the coasting and coal trade, and in the oyster fishery.

The two former branches are stated to be on the increase.

The oyster-beds lie directly off, and about one mile distant from the town, and are very rich, and of considerable extent. They are dredged by a company of working fishermen, incorporated by Act of Parliament.

The gross returns of this company sometimes amount to 40,000*l.* per annum.

I shall now enter upon the description of the following subjects, taking each in the order in which it is placed below—

1. The surface and subsoil drainage.
2. The refuse drainage.
3. The water supply.
4. The streets and open spaces.
5. The lighting, watching, and cleansing.
6. The burial-grounds.
7. The mortality.

1. SURFACE AND SUBSOIL DRAINAGE.—It has already been stated, that one stream only brings into the valley of the town water falling upon the surface beyond its regular natural boundary line, and that this is occasionally formidable, and discharges into the harbour.

Within this boundary line the most important of the water-courses from the hills runs along the side of the turnpike-road, constituting the main street of the town, and also discharges into the harbour, previously for about 700 yards passing through a brick drain, constructed some years since at the joint expense of the inhabitants and of the Commissioners of Sewers.

This water-course also swells considerably after heavy rains, and overflows the road.

All the other water-courses that do not communicate with this or the stream, discharge into ditches in the marshy flat.

These ditches on the western side of the town have no outlet into the sea, other than a small pipe passing through the sea-wall into the beach, the pebbles of which permit a filtration between them, and this vent is so small, that even now they are practically stagnant.

On the eastern side of the town the ditches communicate with the stream above mentioned.

The surface of the flat being below the level of high tide, it follows, that if a heavy fall of rain happen at or near the time of high water, when the outlets seaward are closed, the produce of which falling upon and brought down into the flat exceeds the capacity of its channels; the excess can only spread itself over the flat, unless artificial means be provided for its discharge.

No such artificial means have been provided, and the conse-

quence is, that inundations are of very frequent occurrence, heavy falls of rain, an almost inappreciable quantity of which is taken in by the non-absorbent soil, commonly happening at the time of high water.

Some of the evils and inconveniences resulting from these inundations will be exhibited in the following extracts from the evidence.

Mr. *John Auld* states,—

I am master of the day-school; it is a charity-school; and there are now on the books of the establishment,—

Boys	.	.	.	.	.	198
Girls	.	.	.	.	.	130
						<hr/>
						328
						<hr/>

A little while ago, the marshes at the back of the school were flooded, and the water came up nearly to the school-door; it came within six yards of the door; the marshes are generally wet, excepting in the height of summer; every winter they are inundated, but not to so great an extent as they have been this year, during which so large a quantity of rain has fallen.

The children attending the school are by no means healthy looking, they are pale, and there is usually a good deal of ague amongst them; there is more absence from the school on account of ill health, than from any other cause.

Mrs. *Beal* (widow), who resides in Harbour-street, states,—

A drain from the street passes under my wash-house, and has nothing to cover it except a few planks; the smell from it, in certain states of the weather, is exceedingly bad. The drain is continued open through my yard into a barrel-drain, receiving both surface and refuse drainage.

After the last heavy rains, the wash-house and the sitting rooms were completely flooded; the smell from the water was very bad; we suffered afterwards from colds; it was many hours before the yard was clear; 14 pailfuls of filthy water were taken out of the rooms.

I have frequently severe headaches from the smell in warm weather, and am often compelled to keep the doors and windows shut to exclude as much of it as possible from the house.

I have a well in the yard, and during and for some days after these inundations, which are frequent, the water is unfit for use. I then procure water from the neighbours.

When I go to bed I never feel certain of finding things safe in the morning; if it should rain heavily in the night, the wash-house, the yard, and, perhaps, the sitting rooms, will be flooded.

The soil of the whole flat, including both the marshes and the immediate site of the town, although almost impermeable to moisture, is, nevertheless, loaded with water, which is lodged in the cracks and fissures produced in it by the action of the sun.

This land water in the town is not merely the rain-fall which has drained in from the surface; but consists, in a great measure, of the slops and liquid refuse of the houses, which of course can

have undergone no filtration through the clay, but has entered through the cracks in dry weather.

It is a fruitful source of evil, and must have a most serious effect upon the health of the inhabitants. Every house in the town is rendered damp, every cesspool made doubly noxious, the water of every well more or less polluted by it.

Mr. *Henry Holder* states,—

Where I reside, if the ground be opened to the depth of a foot or 18 inches, water will be found to stand in the hole.

Mr. *James Edward Mitchell Williams*, surgeon, states,—

Mr. George Blaxland's house, situated in the Salts, has usually about four feet of water underneath the floor; the floor is raised two steps above the ground. A short time since upwards of 200 pailfuls were removed from the lower part of the house.

The whole of the houses on that side the town are in a similar condition, the water under them being more or less deep.

Mr. *Henry Holden*, grocer, residing in Whitstable-street, states—

I have a cellar to my house, the floor of which is 4 feet 6 inches below the surface of the road; the water drains from the surface, and from the surrounding earth into it.

I endeavour to keep the water under by means of a pump, which is daily used.

Some two years since, the sea made an encroachment; it came over the wall, and up through the main sewer, and in that manner I was flooded; but this latter evil is of rare occurrence.

The state of the agricultural drainage will be best described by the evidence of Mr. *Hyder*, who states,—

I am a proprietor of land both in Whitstable and Seasalter.

The soil around the town is a very stiff adhesive clay; no water penetrates through it. About one-third of the land in both parishes is thorough drained. I have put in 1,000,000 of tiles myself; the market price of tiles is from 18s. to 20s. per thousand; tiles with soles have been chiefly used; I put in drains $1\frac{1}{2}$ rods (21 feet nearly) apart and 24 inches deep; scarcely any deeper drainage is practised here; very heavy rains render the drainage inefficient, the soil being so exceedingly retentive and swelling; the drains do not recover their action until the earth becomes cracked again by a dry summer.

The salt marshes in the neighbourhood of the town are not drained. I think it doubtful if the salt marshes would be benefited by draining.

The water is generally level with the surface of these marshes, if not over them; should be loath to give 30s. per acre for the herbage; in the vicinity of the town, however, the marshes let for that sum as accommodation land.

Ague is prevalent on the west side of the town, but not so bad as formerly.

I am inclined to think that Mr. *Hyder's* estimate of the proportion of land drained, viz., one-third, is somewhat liberal. Very great benefits, so far as the improvements of the land alone are concerned, have been experienced in all cases.

2. **THE REFUSE DRAINAGE.**—Three modes are generally practised in Whitstable for the immediate disposal of the *faecal* refuse of the inhabitants. By the first, this matter is received in vaults sunk under the privies; by the second, in tubs or other moveable vessels placed beneath the seats of the privies; and by the third it is at once deposited in or upon the banks of the marsh ditches, and this is effected by the privies being constructed either on the edges of or over the ditches.

These are the three modes in general use; but a few of the houses have drains, mostly of very small fall, communicating with the sewers, which were originally constructed for the purpose of surface drainage alone. These sewers are two in number; one of them passes under a portion of the main street; the other, along the east side of the town, and both discharge into the harbour. Those houses only lying immediately along their course have drains communicating with them.

The vaults under the privies are of very small size, and half or three-fourths filled with land water; and when they become completely filled by the addition of the *faecal* refuse, the common practice is to withdraw the solid portion of this matter, and cast it into the nearest ditch; sometimes it is buried; sometimes, but very seldom, it is carted away from the town. This last mode of disposing of it constitutes the rare exception to the rule.

The tubs or other moveable vessels are adopted chiefly by the seafaring population living along the shore; their contents are usually discharged into the sea, into a ditch, or into a stagnant pool, of which there are several on the beach.

The privy over the ditch is preferred by nearly all those persons living along the edge of the marshes or along the small ditches which branch from the marshes into the town. It is, in most cases, a slight wooden erection completely detached from the house, often without a door, and at its base on the ditch side; a large heap of excrement is generally to be seen.

The main ditches near the town are now nearly filled with the matter thus deposited in them, so that in many places at this season only a few inches of water covers it, and in the summer, without doubt, the greater part of the surface must be completely exposed. Many of the smaller ditches are mere surface drains, and contain only a semifluid matter, which is occasionally swept down them with the aid of a broom; and in some of these the matter lies in heaps.

Not the least portion of the solid refuse can escape from the ditches on the western side, the only outlet being the pipe into the beach before mentioned; this may be safely inferred, as one of the persons who accompanied me in the perambulation of the town, did not scruple to taste the water where it bubbled up between the pebbles of the beach; and, indeed, it appeared to be perfectly clear.

The sewer, which passes under a portion of the main street, is about 700 yards in length. It is constructed of brickwork, and its section is a circle 2 feet in diameter; along its course at distances of about 100 feet manholes, covered by wooden hinged flaps level with the ground, have been formed to give facility for cleaning it out, an operation which is performed twice during the year; it is now half filled with deposit.

The other sewer on the eastern side of the town is about 260 yards in length, 18 inches in diameter, and constructed of $4\frac{1}{2}$ -inch brickwork.

With respect to this sewer, it was stated before me in evidence by a Commissioner of Sewers :—

The work was badly done and did not answer, the builder made it hogbacked, so that at one end the water would not flow at all.

Every description of liquid refuse of the houses is passed in nearly all cases along open channels, either into the stagnant ditches of the marshes, into one or other of the two covered sewers which have been described, or into the pools on the beach.

The following extracts from the evidence will best describe the nature and present state of the works of refuse drainage.

Mr. *John Auld*, the master of the day-school, states—

The school buildings were erected four years since; I reside in them. The only provision made for refuse drainage was a pipe passing from the privies into a ditch, the water of which is generally quite stagnant, but flows a little after heavy rains.

The whole of the solid refuse was thus made to pass through the pipe into the ditch; the house water was conveyed into the same channel.

Lately vaults have been constructed to the privies; they were finished about two months since, and have not yet required emptying.

The ditch is not more than 50 feet distant from the girls'-school; it is a great nuisance, more particularly in the summer season and in close weather. I cannot then open the doors and windows on account of it; this applies to the entire dyke round the building, as well as to that portion of it into which the privies immediately empty themselves, that dyke receiving the drainage of all the houses in the street bordering upon it.

I am not so well in health as I was before I came here, and my wife suffers much from ill health, and thinks it is solely in consequence of the state of the ditches; she suffers from an affection of lungs and from general debility; my children are not strong. I have lately had the measles in the house; the measles are now so prevalent that both the boys and the girls'-schools are broken up in consequence, and have been for nearly a fortnight past.

Mr. *William Knight*, draper, residing in Whitstable-street, states,—

About two years since I constructed a vault to my privy to receive the soil; before that time the soil accumulated in a pail and was afterwards thrown into a ditch at the back of the house. The ditch is nearly stagnant, and 130 feet distant from the house. This ditch is not the

main ditch, it was cleaned out about three years since, and also about seven years prior to that. The smell from it is extremely offensive in hot weather.

The house water flows over the ground (not in any brick drain) into the same ditch; that is the case with the water of all the neighbouring houses.

Nearly all the other houses in the row still use the pail to receive the privy soil.

I have never yet emptied the privy vault; do not know how I shall do it; shall, probably, have a cart to take it away; some dig holes and bury the privy soil; have never paid for the removal of such matter.

Mr. Henry Holden, grocer, states upon this subject,—

My privy is situated in the yard near the house; I have a privy pit $3\frac{1}{2}$ feet deep; if cleaned out to-day it would be full of water to-morrow.

The house water flows along an open drain into the main sewer; the smell from the sewer is exceedingly bad. I have used every exertion to keep the drain clear, but the water lies and stagnates in it.

The contents of the cesspools are frequently cast into the sea, and the smell on the beach from this cause is sometimes insufferable.

At the detached part called Church-street, which is situated upon high ground, and where ample fall might be obtained, the system adopted does not appear to be much better.

Samuel Hodges, smith, states,—

I reside at Church-street; the measles are now much about the place; two years since we had typhus there very badly.

The privy of my house is situated in the garden, the seat has a drawer underneath; this I take out every three weeks or a month, and deposit the contents where I put my coal ashes.

The house water is conveyed by a drain into an open ditch, which takes it down to the lower level; there is no cesspool on the premises.

James Wood, shoemaker and sexton of Whitstable, who also resides at Church-street, states :—

Typhus was prevalent in the place two years since; about half the families there were attacked by it. There are 19 houses in Church-street; three men and one child died of the fever, the men were all young and married, two of them have left families.

I have a vault to the privy of my own house; when it is full I take the matter into the yard, and mix it with the coal ashes; the house water runs into an open ditch, sometimes the ditch smells badly; formerly the privy soil also was conveyed into this ditch by a drain. The ditch is 40 or 50 feet from the house.

Mr. James Edward Mitchell Williams, surgeon, states :—

The principal parts of the town are subject to typhus and ague, particularly Harbour-street, Sea-street, Waterloo-place, and the parts lying near the marshes, and called the Island; in these cases of fever and diarrhœa are very common.

These parts also suffered much from the cholera in 1834; there were in all 65 deaths from this cause.

The state of the refuse drainage is by no means what it should be; I

have observed that the inmates of those houses, the drainage of which is in the worst state, suffer most from fever and general bad health.

3. **WATER SUPPLY.**—Whitstable had formerly no other supply of water for domestic purposes, (with the exception of the stagnant water in the ditches); but that derived from some springs which issue from the southern side of the hills, at the back of, and about a mile and a half distant from the town, and which are private property.

This supply, from the means of conveyance used, if from no other cause, was far from abundant; the water was brought into the town in carts, and sold to the inhabitants at the rate of a half-penny and three farthings per pailful, and produced a considerable income to the proprietors. One of these springs brought a rental of 50 guineas per annum.

About 50 years since, a Mr. Nutt projected a scheme for conveying the water of a spring, situate upon the bend of Clapham Hill, into the town, by means of wooden and earthenware pipes.

I have not been able to obtain a very clear account of the nature of this scheme, or of the extent to which it was carried, but have been informed that it failed, and mainly in consequence of the spring becoming exhausted.

It appears, however, that the earthenware pipes were used to convey the water across the higher land, and that the wooden pipes were laid in the lower levels where the column of water would create a considerable pressure.

The earthenware pipes had been manufactured at Hythe at a cost of 6*d.* each, and one of them which was shown me I found to measure 1 foot in length, and 2 inches in diameter, and to be of very excellent material and workmanship.

The water was pumped from the spring by manual labour to a height of about 20 feet into a cistern, communicating with the line of pipe, through which it was conveyed into the valley of the town for distribution by means of the cart and pail.

An analysis of the water of one of these springs, which is probably a fair sample of the whole of them, shows it to be of the quality of 17 $\frac{3}{4}$ ° of hardness. The water is clear, sparkling when fresh drawn, and pleasant to the taste.

Shortly after the attempt of Mr. Nutt, the discovery was accidentally made in Whitstable, of a stratum containing water lying immediately under the bed of clay on which the town stands, and at a depth of from 60 to 70 feet. This stratum (which is doubtless the chalk), it was found on being tapped yielded an abundant supply of water, which rose in the bore, upon the principle of the artesian well, and to near the surface of the ground.

Since the discovery, the town has been entirely supplied with water from this source.

It is usually obtained in the following manner:—

A common well, about 4 feet in diameter, which is intended to serve as a reservoir, is sunk into the clay, to a depth of 8 or 10 feet, and a hole is then bored with a $2\frac{1}{2}$ inch auger, entirely through the clay, and into the stratum beneath, containing the water, which upon being tapped, rises up the bore to within 2 feet of the surface of the ground.

The well is usually lined with brickwork, and the bore with a wooden or tin tube, but sometimes the well is carried only a few feet deep, and the bore is left quite unprotected: in this case a supply of water may be obtained at a cost not exceeding 50s. or 3*l*.

This water, when the well is sound, is clear and pleasant to the taste: an analysis of a sample taken from Mr. Spenceley's well, 65 feet deep, and near the sea, shows it to be of the quality of 22° of hardness.

The Railway Company, in order to obtain a better water, carried their well near the harbour, which supplies a steam-engine, to a depth of 212 feet. The water of this well, in appearance and taste, is not superior to the other, and the analysis shows it to be of 32° of hardness.

A large proportion of the houses in Whitstable possess separate wells, from the cost of sinking them being so trifling; in some cases, however, several houses are supplied from the same well. The greater number of the wells are kept in the most slovenly manner, very commonly without any cover; and with a pool of filthy house-water stagnating near their mouths, and at times dripping into them. The wells are liable to be affected, too, by the land water, which enters through the imperfect brick-work with which they are lined; and, indeed, the water of nearly all the wells in the town is more or less polluted from this cause.

I transcribe some passages from the evidence having reference to the water and the state of the wells.

Mr. *William Knight*, draper, states:—

I obtain water from an artesian well; the water is generally clear; there is a peculiar taste about the water at times; do not know the cause of it; have been careful to have the well cemented to protect it from land-springs.

The well water is discoloured after heavy rains, and the disagreeable taste is then stronger; it is a kind of earthy taste.

The water is hard, it does not make good tea; it is used sometimes for washing linen with a large quantity of soda; the depth of a well is usually 60 feet all over the town: the quality of all the water is nearly similar.

The water of my well has never been lower than two feet from the surface; it generally rises to within one foot of the surface. I use carbonate of soda in tea-making.

Mr. *John Auld*, master of the school, states:—

The water with which the school is supplied is derived from a well

sunk in the yard, and is at present very bad ; it is frequently discoloured, and I think it is at all times affected by the land drainage. The house-water is conveyed in an open brick drain to a point near the well, where it falls through a grating into an underground drain ; the grating is not more than two feet from the well, and the overflow from the well goes to and also falls through this same grating. Some time since the underground drain became accidentally stopped up, when all the house-water, having no other vent, flowed into the well ; since that time we have not been able to use the well-water, and we now send into the street to procure our supply. The children may have drank the water before the stoppage was discovered. I think that the house-water, percolating through the earth, may affect the well.

Mr. *J. E. M. Williams*, surgeon, states :—

I think the water good if the wells are properly made ; many of the wells are affected by the bad drainage ; the water is slightly impregnated with iron ; I find the water improve by exposure to the air.

4. STREETS AND OPEN SPACES.—It has been stated that the turnpike-road from Canterbury, continued through to the sea, constitutes the main street of the town, and this which is of course repaired by the trustees ; is not only the main, but the best-conditioned street in Whitstable. Its use, however, involves a constant tax upon the inhabitants, a toll-gate being placed nearly in the centre of the town.

The greater number of the other streets are occasionally repaired by the surveyor of the highways of the parish in which they are situated ; but there are some streets in the town which are disclaimed by the surveyor, and which are never repaired at all ; of these, Harbour-street, the main thoroughfare to the railway, is one.

The formation of nearly all these streets is extremely defective ; in hardly any case is the proper curve given to the surface, and in many the surface is absolutely flat, or inclined inwards, so that the water lies and stagnates upon it ; the metalling too is nearly always very imperfect, and in wet and moist weather the mud, which is never scraped from it, accumulates to a great thickness.

As an instance of the state of the streets I may mention that in the perambulation of the town I was myself, to avoid getting wet-footed, obliged to pass through Harbour-street upon stepping stones which had been placed there by some individual for his own convenience, or, in a disinterested spirit, for that of the public.

A considerable sum, however, of which the town contributes a large share, is annually raised and expended in both parishes upon the repair of the roads.

Mr. *Wharton* states :—

The highway-rate of Whitstable parish usually produces about 350*l.* annually ; of this amount,

About 180 <i>l.</i> is collected in the country,			
„	50 <i>l.</i>	„	from the Railway Company,
„	120 <i>l.</i>	„	in the town.
<hr/>			
350 <i>l.</i>			
<hr/>			

I am informed that much dissatisfaction exists amongst the townspeople as to the management and distribution of this fund; a most insignificant part being usually expended upon the streets of the town, and nearly the whole of it applied to the improvement and repair of the country roads.

The proportionate expenditure will be best exhibited in the evidence of Mr. William Beer, the surveyor of highways for Whitstable parish, who states,—

About 350*l.* is annually expended upon the highways in Whitstable parish.

The houses in Harbour-street are rated to the highways and always have been, but the road has never been repaired from the highway fund. I think Harbour-street ought to be repaired by the turnpike trust; I would not repair the road without first taking the sense of the parishioners.

About 4*l.* or 5*l.* is the amount of the usual annual expenditure upon the streets of the town.

It should be stated that the surveyor of highways has almost invariably been nominated by the country party, and has himself been resident in the country.

The state of the footpaths is about on a par with that of the streets; there is no foot-pavement, properly so called, in the town.

There are several open spaces in the town; of these, Waterloo-place is one, and a fair specimen of the others. The surface of this is literally black with filth, and dotted with heaps of the most offensive refuse and rubbish, or with pools of stagnant filthy water.

5. LIGHTING, WATCHING, AND CLEANSING.—There is no public lighting either by gas or oil. The town, therefore,—which it must be remembered contains upwards of 3000 inhabitants,—excepting during the moonlight nights, is left in total darkness.

The town is equally destitute of watchmen, and the want of some protection to property during the dark nights of the year is much felt.

There is no public scavenging whatever practised in the town.

6. THE BURIAL-GROUNDS.—The town has the use of two burial-grounds: one at Church-street, and attached to the old church of Whitstable parish; the other in the middle of Seasalter parish, and about one and a half miles distant.

The burial-ground of Whitstable parish, including the church, is about one acre in extent. It is much crowded with graves:

and as it is preferred to the other ground, nearly all interments of persons dying in the town take place here.

James Wood, sexton of Whitstable parish, states,—

The churchyard is very full; formerly it was the practice to bury upon the south side of the yard; people generally prefer being buried on the south side. I usually give a foot between each grave; sometimes not so much; full-sized graves are made 5 feet deep.

I bury about 70 corpses every year from the two parishes of Whitstable and Seasalter; think there is now room for about 100 more.

The ground of the churchyard cracks very much in summer. When the cholera was here about 60 people were buried in three months: I could then smell the bodies; the ground was very dry at the time. I think the churchyard ought to be enlarged.

I sometimes bury in the church; have buried in all four corpses in the church; only one of these was buried in lead: there is room for only a few more inside the church; have heard no complaints of smell inside the church after interments.

The burial-ground of Seasalter parish is about three-fourths of an acre in extent, and is but thinly occupied by graves. This ground offers accommodation for some years to come; but there appears to be a prejudice amongst the people against being buried here.

7. THE MORTALITY.—The average annual number of births in the two parishes of Whitstable and Seasalter during the five years 1844-8 was 142.

The average annual number of deaths in the two parishes during the same period was—

From all causes	64·8
Of infants not exceeding the age of 12 months	15·4

The average annual number of deaths from epidemic, endemic, and contagious diseases in the sub-district of Whitstable, which includes the three parishes of Whitstable, Seasalter, and Swalecliff, during the same period was 13·4.

Taking the population of the two parishes of Whitstable and Seasalter at 3319, and that of the sub-district of Whitstable at 3484, the numbers according to the census of 1841, the average proportion of births and deaths to the population during the above-mentioned period was as follows, nearly—

	To Population.
Births	1 in 23
Deaths from all causes	1 in 51
Deaths from epidemic, endemic, and contagious diseases	1 in 260
Deaths of infants not exceeding the age of 12 months	1 in 215
The proportion of deaths of infants under the age of 12 months to the births during the same period was 1 in 9 nearly.	

As a means of comparison I will state the proportions of births and deaths occurring in the Elham and Bridge district, in the same county, during the year 1841, as given in the table published by the Health of Towns' Association, placing them for convenience of reference in juxtaposition with the preceding:—

	Average Proportion of Births to Population.	Average Proportion of Total Deaths to Population.	Average Proportion of Deaths not exceeding 12 Months to Population.	Average Proportion of Deaths from Epidemic, Endemic, and Contagious Diseases, to Population. (Sub-district.)	Average Proportion of Deaths to Births.
Elham and Bridge District	1 in 32	1 in 64	..	1 in 475	1 in 12
Whitstable and Seasalter Parishes	1 in 23	1 in 51	1 in 215	..	1 in 9
Whitstable, sub-district .	..	..	..	1 in 260	..

It thus appears, upon the average—

1. That while a birth takes place annually in every 32 of the population of Elham and Bridge, one occurs annually in every 23 of the population of Whitstable and Seasalter, or that 38 children are born every year in those parishes more than are born during the same period in an equal number of the population of Elham and Bridge.

2. That while 1 in every 64 of the population die annually in Elham and Bridge, 1 in 51 die annually in Whitstable and Seasalter; or that 13 individuals die every year in Whitstable and Seasalter, who would not die if those parishes were as healthy as the district of Elham and Bridge.

3. That while 1 in every 475 of the population die annually from epidemic, endemic, and contagious diseases in Elham and Bridge, 1 in every 260 die annually in the sub-district of Whitstable from the same cause; or that 6 individuals die every year in the sub-district of Whitstable from those diseases who would not die if it were as healthy as the district of Elham and Bridge.

4. That while of all those born at Elham and Bridge, 1 in 12 die before they have attained the age of 12 months, 1 in 9 die in Whitstable and Seasalter under the same age.

The most striking feature of the above table is the large excess of births in Whitstable and Seasalter over those of Elham and Bridge, at the same time that the rate of the mortality in the former is considerably higher than in the latter. This would seem to indicate that a sickly population increases more rapidly than a

healthy one, producing large numbers of children only for them to be swept off by death prematurely.

There appears to be no essential reason why the rate of the mortality should be higher at Whitstable than at Elham and Bridge, in the same county, and distant only a few miles. The population of Elham and Bridge, it is true, is very thinly spread; but that of Whitstable is by no means crowded, certainly not to an extent to influence the duration of life. The natural air of Whitstable is more keen than that of Elham and Bridge, but it is the sea-air, and this has never been considered prejudicial to health and longevity.

We must look, then, for some cause, not proceeding from the overcrowding of the population, or from the situation, or climate for the greatly increased mortality in Whitstable, and can there be a doubt that this is to be found in the exhalations from the occasional sheets of water, from the almost constantly moist surfaces, and the offensive stagnant ditches surrounding the town; from the water with which its subsoil is loaded, and the accumulations of filth, both liquid and solid, with which every part of it abounds?

I may mention that the Elham and Bridge district is chiefly situate upon the chalk, a rock which, by the process of absorption, quickly removes the surface water, and thus effects a natural drainage of the site; being exactly the reverse of the process at Whitstable, where the surface water is retained by the clay soil for constant evaporation.

The chalk rock, too, performs in some measure the functions of a system of refuse-drainage, by absorbing from the cess-pools sunk in it the liquid or most noxious portion of the matter, and thus by removing one source of disease tends to promote the healthiness of a locality; while the clay retains every drop of the liquid refuse for fermentation, causing every cesspool to become a breeding-place of fever and contagious disease.

RECAPITULATION AND SUMMARY OF CONCLUSIONS.

1. That the site of the town, as regards the formation of the ground, its relative position or level with respect to the sea, and the nature of its soil, is naturally very unfavourable to the quick discharge of surface water, and the ready absorption of moisture; and that it requires the aid of artificial means to effect these objects.

2. That such artificial means have not been provided, and that the results of this deficiency are the periodical inundation of the flat of the town, the almost constantly moist state of its surface, and the prevalence of a humid atmosphere and thick fogs.

3. That the present provision for the reception and removal of the excrementitious refuse of the inhabitants is extremely and most disgustingly imperfect, and that scarcely any portion of this matter is now applied to fertilize the surrounding land, but nearly the whole of it wasted.

4. That much inconvenience, pecuniary loss, sickness and mortality is occasioned by the inadequate provision of works for the surface and subsoil drainage of the town, and for the reception and removal of its refuse.

5. That the present supply of water is defective both as respects the mode and the quality of the supply, the wells being liable to pollution from the land and refuse drainage, and the water being of a degree of hardness which occasions a heavy pecuniary loss to the town.

6. That the pavement of the streets and footpaths is imperfectly formed and repaired, and that these, together with the open spaces, are insufficiently cleansed.

7. That there is a total absence of public lighting and watching, and of any system of public scavenging.

8. That the present extent of burial ground is insufficient.

9. That the present boundaries, being irrespective of the natural drainage area, and also destructive of the unity of the town by dividing the builded area into two parts, are not those best suited to it.

10. That the present governing powers are such only as are commonly in force over the rural districts, and that they are totally inadequate to the existing and growing wants of the town.

11. That there are no local Acts of Parliament in force within the town, having relation to any of the purposes of the Public Health Act.

12. That there does prevail in the town extensive epidemic, endemic, and contagious disease, and a low state of health, and excessive infantile and adult mortality; and

13. That the comfort, health, and condition of the inhabitants generally would be improved—

a. By the better drainage of the surface and subsoil of the site of the town, and of the suburban district.

b. By an efficient system of refuse drainage, which shall provide for the instant removal from the town of every description of liquid refuse, and of that portion of the solid refuse capable of removal by suspension in water.

c. By a well-organized system of public scavenging.

d. By an improved supply of water carried into every house.

e. By better formed, and more perfectly repaired and cleansed, streets and foot-pavements.

f. By the abolition of all cesspools and open stagnant pools and ditches.

g. By a system of public lighting and watching.

SECOND PART.

From the facts detailed in the preceding part of this Report, it is to be presumed that the Board will accede to the prayer of

the petitioners, and determine to extend the provisions of the Public Health Act to the town of Whitstable.

It becomes, therefore, necessary to determine the limits of the district to which the Act is to be applied, and further, it is desirable to take into consideration the proper remedies for the evils complained of, and which have been shown to exist in this town in a more than ordinary degree of intensity.

I propose, in the first place, to describe the boundaries of the district which, in my opinion, may be most advantageously adopted for the purposes of the Act; secondly, to set forth, although very briefly, my views as to the constitution of the Local Board; and afterwards to consider the question of the remedies.

As, however, the full consideration and exposition of this part of the subject would consume more time than can at present be devoted to it, and would draw this Report out to an inconvenient length, I intend to confine myself to those remedial works, the determination of which involves more particularly broad and general principles, and the economical construction and efficient action of which demand that they should be carried out simultaneously, and upon an uniform system. For the same reasons, I shall treat these only in a cursory and general manner.

These works consist of—

1. The works for the supply of water to the town.
2. The works for the refuse and surface drainage of the town.
3. The works for the surface and subsoil drainage of the flat portion of the district.
4. The works for the application of the sewage water to the soil.

THE BOUNDARIES OF THE DISTRICT.—The line, which after a careful examination of the site I recommend should be adopted for the boundary of the district to which the Public Health Act is to be applied, is identical with the regular watershed line of the hills almost encircling the town.

This boundary is represented by a dotted line on the plan; it commences at the highest point of the cliffs, eastward of Tankerton Castle, and takes almost a straight course, excluding St. Ann's Barn, to a point a little to the east of the parish church of Whitstable, at Church-street; thence it continues nearly straight, passing not far from, and including the buildings of Frog Hall, to the road beyond: it then inclines to the west, and takes a perfectly straight course to the most elevated point of Bostall-hill, and from this point it continues along the brow of the high land, and terminates on the seashore, beyond the marshes on the west of the town. The line includes the whole extent of the flat which constitutes the immediate site of the town, and also that of the uplands draining into this flat, with the exception of the before-mentioned area of high land lying to the south, and beyond the regular line of the hills.

I have not considered it necessary to include this latter area, as it is purely agricultural, and no other drainage, excepting the unmixed surface water, is ever likely to pass from it.

The total area of the district included is about 700 acres in extent; and of this quantity, 225 acres are in the parish of Whitstable, and 475 acres in the parish of Seasalter.

About 500 acres of this district consists of hilly or undulating land, chiefly under arable or meadow cultivation; the remainder of the district, about 200 acres, is perfectly flat, and, with the exception of the builded area, and the beach consists entirely of marsh land.

The marsh area is about 120 acres in extent.

THE LOCAL BOARD OF HEALTH.—In the formation of the local Board consideration must be given not only to the size of the town and the amount of business to be conducted, but also to the peculiar class and habits of the population, and the amount of information diffused amongst it.

With reference to the amount of business, in this case it is never likely to exceed that which may be easily managed by the Board entire, and without the aid afforded by division into Committees being necessary.

A good idea may be formed of the class mainly composing the population of the town by an examination of the list of houses given in a preceding part of this report, which shows that out of a total of 605 houses, 497 do not exceed the annual value of 10*l.*, that 22 only exceed the annual value of 20*l.*, and that there is not a single house in the town above the annual value of 30*l.*

The degree of general information possessed by the inhabitants may be estimated from the same source, as it must of necessity be in proportion to their means.

The better class of the population of Whitstable is not a moving one, but as a rule almost constantly resident.

The consideration of these circumstances leads me to the conclusion that it will be to the advantage of the town that the Local Board should be composed of a small number of members; as thus its business will be more easily and quickly transacted, party spirit and dissension will be less likely to prevail; and election to it will become an object of stronger interest with the more intelligent and better informed portion of the inhabitants.

The clause of the Act which directs that one-third, or as nearly as may be, of the members composing the Local Board shall go out of office every year, renders it desirable that the total number of members shall be one which may be divided by three.

Under all the circumstances, I am of opinion that it will be most advantageous to the town that the Local Board of Health should be composed of six members, and that three should form a quorum.

THE WORKS FOR THE SUPPLY OF WATER.—In deciding upon the source whence the water supply of a town is to be taken, the most important point to be considered is that quality of the water termed hardness.

Rain or distilled water is quite free from hardness. The quality is therefore due to the presence of some foreign matter or impurity in the water; and this consists generally of some of the earthy salts dissolved in it.

Dr. Thomas Clark, some years since, formed a scale for measuring the hardness of waters, and discovered a very simple and accurate test, called the soap test, for determining its amount.

According to the scale of Dr. Clark (which is now universally adopted) "each degree of hardness indicates as much hardness as would be produced by one grain of chalk per gallon, held in solution in the form of bicarbonate of lime, free from any excess of carbonic acid."

That an economy results from the use of a soft water for domestic purposes must be too well known to need insisting on here, indeed this is proved by the expensive apparatus of water-butts, cisterns, and tanks, so generally resorted to procure even an insufficient supply of it; the extent of this economy is however by no means well understood, and it may therefore be mentioned that for the single purpose of washing alone, in the less consumption of soap, and in the smaller wear and tear of linen, consequent upon the reduced labour of the operation, every family having a soft water at command effects a very considerable pecuniary saving by it on the expenditure which the use of a hard water would occasion.

It may further be stated that this economy extends over almost all the operations in which water is used.

In a pamphlet lately published by Dr. Clark the cause of the saving as respects washing is explained as follows:—

The bicarbonate of lime dissolved in water destroys a proportional quantity of soap, before it is possible to produce in the water a lather by the rubbing of soap; that is to say, before it is possible to have in the water undestroyed soap available for washing purposes.

Dr. Lyon Playfair estimates the amount of the money saving that would accrue to Liverpool or Manchester by the use of a water equal in softness to that of Aberdeen at 60,000*l.* per annum in the consumption of the articles of soap and soda alone.

The waters of both Liverpool and Manchester are of 16° of hardness, while that of Aberdeen, the produce of the rainfall upon the granite, is of only 2° of hardness; there is then a difference between them of 14°, and this amount of hardness, according to the estimate, causes, on the average, a money loss of 4*s.* annually to each individual of the population in the expenditure for those articles alone.

The proportion which the cost of the water supply of a town bears to that of the soap and soda consumed in it is not generally known.

The quantities of soap and soda consumed annually in the metropolis are estimated as follows :—

	£.	£.
Soap, 12,000 tons, at 50	=	600,000
Soda, 3,000 tons, at 10	=	30,000
		<hr/> £630,000 <hr/>

Dr. Clark, who made the above estimate from the best information to be obtained, observes with respect to it :—

Now, since the last Parliamentary Returns made in 1834, show that the gross water rent of the Metropolitan Companies was in that year about 270,000*l.*, we have scope for a subsequent increase, and yet may be within safe limits when we assume that the value of soap and soda consumed in the metropolis is double the gross water-rent. Hence, if there be a saving of only 10 per cent. on the value of the soap and soda consumed, it would correspond to a saving of 20 per cent. on the gross water-rent.

It is not, however, alone in soap and soda that a saving arises from the use of soft water in washing. The labour in washing clothes is much increased by the use of hard water, and the wear and tear in consequence is probably a more expensive item than the additional soap. When the cost of wear and tear is kept in view it may be doubted, whether any real saving arises from the excessive use of soda that is now so common.

Whitstable has three sources of water-supply at command :—

1. The surface-water falling upon the elevated land at the back of the town.
2. The natural springs on the south side of Clapham Hill.
3. The artesian wells sunk into the chalk stratum beneath the town.

I caused samples of each of these waters to be procured and forwarded to Dr. Lyon Playfair for analysis to ascertain their hardness.

The following table exhibits the results obtained, and Dr. Playfair's remarks upon the waters :—

Designation.	Hardness.	REMARKS.
1. Surface-water :— Sample taken from stream between the hills at the back of the town.	0 20	This water had a horrible smell and yellow deposit.
2. Natural springs, Clapham-hill :— Sample taken from Mr. Hyder's springs.	17 $\frac{3}{4}$	This water was clear, free from deposit, and well tasted.
3. Artesian wells :— a. Sample taken from Mr. Spenceley's well, near the sea, 65 feet deep.	22	The same.
b. Sample taken from South-Eastern Railway Company's well, on the pier; 212 feet deep.	32	The same.

It will have been observed that the softest of these waters is harder than the waters of Liverpool and Manchester.

The first source of supply to be considered is the surface-water of the elevated land at the back of the town, and which has been shown to be of 20° of hardness.

The total area of gathering ground, the rainfall upon which might be conducted into a reservoir at the point D, sufficiently elevated for distribution without artificial power is about 180 acres, an extent capable of affording a supply ample in quantity for all the wants of the town.

It should be stated that the sample of this water was taken from the stream when in a low state, and it is probable that the produce of heavy storms would show a widely different result as to hardness.

With respect to the "horrible smell and yellow deposit," there can be little doubt that the water would spontaneously purify itself by long keeping in large reservoirs.

In the present state of uncertainty, however, on these points, and the limited experience we possess as to the use of surface waters from clay-lands, I do not feel justified in recommending the adoption of this source of supply.

The next source of supply is that offered by the natural springs on Clapham Hill, the water of which has been shown to be of $17\frac{3}{4}^{\circ}$ of hardness.

With respect to this source of supply the information before me is extremely limited. I have not been able to obtain any satisfactory information, first, as to the quantity it would yield; secondly, as to the cost of the works necessary to convey the water to the town, the extent of which can only be determined upon accurate levels; and thirdly, as to that of purchasing the rights of the proprietors of the springs.

The determination of these points would have consumed more time and involved a greater expense than in my judgment the promise of the springs justified; this water, in its natural state, being of a degree of hardness which renders it quite unfit for the purposes of washing. I of course, under these circumstances, reject this source of supply.

The only other source of supply left is that offered by the artesian wells; and the most favourable sample of which has been shown to be of 22° of hardness, and this (reserving the right to any change of plan which the fuller information to be obtained before the execution of works may show to be proper,) I now recommend for adoption. I purpose, however, to soften this water by subjecting it to the very beautiful process invented by Dr. Clark for that purpose.

With this view I caused another sample of water to be taken from Mr. Spenceley's well, and to be forwarded to Dr. Clark (with his permission), for experiment.

After subjection to the process, this water was reduced to under

5° of hardness: an amount which, although exceeding that of the waters with which some towns are supplied, yet such as to permit its economical use for all domestic purposes whatever.

It thus appears that more than 75 per cent. of the hardness is taken from the water by this process.

Dr. Clark has calculated that at 22° this water would take 45 ounces of soap per 100 gallons, to make a lather; and that at 5° it would take less than 12 ounces.

It is unnecessary to enter here into a description of a process, with which the Board are well acquainted. I may state, however, for general information, that it is one of an extremely simple and inexpensive kind.

Having thus fixed upon the source of supply, it now only remains to determine the quantity of water requisite for the wants of the town, and the nature of the works for obtaining, purifying, storing and distributing it.

I estimate the quantity of the supply required at 20 gallons daily for each individual of the population; this will give 65,000 gallons for the daily consumption of the town, and 23,000,000 gallons nearly, for its annual consumption.

I propose the following works for obtaining the water and for its purification, storage, and distribution:—

1. The sinking of a well near the point A.
2. The erection of a steam-engine near the same point.
3. The formation of a purifying basin near the same point.
4. The formation of a storage reservoir on Bostall Hill, at B.
5. The laying of a main between the steam-engine and the basins and reservoir; and of a system of branch distributory pipes throughout the town.

With respect to these works, I may state further that I propose that the supply should be on the constant principle, and unlimited, and that every house should have as a minimum accommodation two orifices of discharge from the system of pipes; one communicating with the kitchen or wash-house, the other with the water-closet.

With regard to their probable cost I may state, that although the local data before me are extremely imperfect, yet a careful examination of the site and my knowledge of the cost of similar works in other towns, lead me, with some confidence, to the conclusion that they may be executed for a sum not exceeding 3,500*l*.

The above estimate, however, must be taken for what it really is, namely, an approximate one only; and I have given it solely from a desire to place the fullest information I possess, consistent with the scope of this report, before the Board, and before the parties interested in the question.

To prevent the necessity of immediate heavy outlay by owners and occupiers, I recommend that, for the execution of these works, and also of those to be presently described, the Board should

exercise its powers, and sanction advances of loans, upon mortgage of the rates, from the Commissioners of Public Works or others, for the full period of 30 years, to be repaid by annual instalment of principal and interest.

The annual instalment of principal and interest, at 5 per cent. upon the sum mentioned; and the working expenses will stand as follows:—

Annual instalment of principal and interest at 5 per cent.		£.	s.	d.
on 3500 <i>l</i> .	.	207	1	8
Working expenses and repairs, say	.	150	0	0
Total		£357	1	8

The annual rates to meet this sum might be distributed as follows:—

	£.		s.	d.		£.	s.	d.
76 houses not exceeding	5	at	6	6	=	24	14	0
421 „ „	10	„	10	10	=	228	0	0
57 „ „	15	„	15	0	=	42	15	0
29 „ „	20	„	18	0	=	26	2	0
22 „ „	30	„	25	0	=	27	10	0
						£369	1	0

leaving a small surplus for contingencies.

Thus, on the above scale of charges, a full and unlimited supply of pure soft water would be afforded to a house not exceeding 5*l*. annual rental, at a charge of 1½*d*. weekly; and to a house not exceeding 10*l*. annual rental, at a charge of 2½*d*. weekly.

In forming a correct estimate of the burthen to be created by the above charges, consideration must be given to those now accruing from the present water supply, and which will be annihilated by the new system, viz., the cost of maintenance of the wells, and of the tanks and water-butts for catching and preserving for the purposes of washing, the insufficient quantity of rain falling on the dirty roofs of the buildings, that of the labour of fetching water, and that occasioned by the greater wear and tear of clothes, the extra expenditure for soap, for soda, for tea, for malt, &c. &c., and when they shall have been fairly computed, and the two amounts compared, I shall be much surprised if this burthen is not proved to be altogether imaginary; and if the establishment of these works is not found to occasion an actual money saving to the town.

THE WORKS FOR THE REFUSE AND SURFACE DRAINAGE OF THE TOWN.—In the system of refuse and surface drainage I intend to provide for the removal from the town, 1st, of every description of liquid refuse, consisting principally of the house water and slops; 2ndly, of all that portion of the solid refuse capable of removal by suspension in water, and which consists chiefly of the excre-

5° of hardness: an amount which, although exceeding that of the waters with which some towns are supplied, yet such as to permit its economical use for all domestic purposes whatever.

It thus appears that more than 75 per cent. of the hardness is taken from the water by this process.

Dr. Clark has calculated that at 22° this water would take 45 ounces of soap per 100 gallons, to make a lather; and that at 5° it would take less than 12 ounces.

It is unnecessary to enter here into a description of a process, with which the Board are well acquainted. I may state, however, for general information, that it is one of an extremely simple and inexpensive kind.

Having thus fixed upon the source of supply, it now only remains to determine the quantity of water requisite for the wants of the town, and the nature of the works for obtaining, purifying, storing and distributing it.

I estimate the quantity of the supply required at 20 gallons daily for each individual of the population; this will give 65,000 gallons for the daily consumption of the town, and 23,000,000 gallons nearly, for its annual consumption.

I propose the following works for obtaining the water and for its purification, storage, and distribution:—

1. The sinking of a well near the point A.
2. The erection of a steam-engine near the same point.
3. The formation of a purifying basin near the same point.
4. The formation of a storage reservoir on Bostall Hill, at B.
5. The laying of a main between the steam-engine and the basins and reservoir; and of a system of branch distributory pipes throughout the town.

With respect to these works, I may state further that I propose that the supply should be on the constant principle, and unlimited, and that every house should have as a minimum accommodation two orifices of discharge from the system of pipes; one communicating with the kitchen or wash-house, the other with the water-closet.

With regard to their probable cost I may state, that although the local data before me are extremely imperfect, yet a careful examination of the site and my knowledge of the cost of similar works in other towns, lead me, with some confidence, to the conclusion that they may be executed for a sum not exceeding 3,500*l*.

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THE WORKS FOR THE REFUSE AND SURFACE DRAINAGE OF THE TOWN.—In the system of refuse and surface drainage I intend to provide for the removal from the town, 1st, of every description of liquid refuse, consisting principally of the house water and slops; 2ndly, of all that portion of the solid refuse capable of removal by suspension in water, and which consists chiefly of the excre-

mentitious matter produced in the habitations; 3rdly, of the surplus rain-water falling upon the roofed and paved surfaces, with the matter washed up by and suspended in it.

To effect these objects in the most efficient and most economical manner, I recommend for adoption the converging system of drainage, as explained by Mr. Austin in evidence before the Sanitary Commission, 1848.

In applying this system to Whitstable I propose to sink a well 12 feet in diameter, at or near the central point A, near to, but perfectly isolated from, the proposed well for the water supply. It will be lined with brickwork, and carried down to a depth, say 15 feet, sufficient to ensure an effective fall to the entire system of drains which will communicate with it from every house in the town.

The size of these drains will be determined either upon a calculation of the requirements of the area to be drained, or of those of the solid matters entering them, or upon the conveniences of manufacture; and it will be graduated, increasing from the extremities of the system to the centre. The diameters of the tubes at the extremities will be $1\frac{1}{2}$ inches, 2 inches, and 3 inches, and the diameters at the outfalls into the centre well will probably not exceed 10 inches.

The inclination of the drains will be about 1 in 250, this fall being ample to ensure a velocity of flow through them sufficiently high to prevent deposit of the suspended matter, but the rate of inclination will vary inversely as the size of the drain.

In all cases, on account of the economy both of length and fall, the course of the drains will be the shortest that can be taken, and this will be found generally to be along the backs of the houses to be drained, rather than along the streets; the kitchen, and water-closet, where the greater part of the refuse is produced, being commonly placed at this part of the habitations.

I propose that these drains should be manufactured of stoneware or earthenware, in lengths of from two to three feet, and of cylindrical form. This material offers the advantages of great cheapness in the first cost, extreme durability, and perfect impermeability.

The system of pipes will have, directly or indirectly, at least three communications with every house in the town; one with the water-closet, the pipe from which will be 3 inches in diameter; another with the kitchen or washhouse, the pipe from which will be $1\frac{1}{2}$ inches in diameter; and the third with the roofed and paved surface, the pipe from which, in an ordinary-sized house and yard, will be 2 inches in diameter.

The system will have communications, where desired, with the stables and cow-houses; the pipes from which will be commonly 3 inches in diameter, and also with the streets, at proper distances; these pipes will be 3 inches in diameter.

The whole of these communications will be protected at the mouths against the entrance of foreign matter ; and to prevent the emission from them of noxious gases, they will be trapped with the syphon trap.

To admit air into the system, I propose to carry up occasionally pipes to the highest points of the houses, or to make use of such of the rain-water pipes for the purpose as may be used without inconvenience.

• The pipes communicating with the houses, will receive the house-water and slops, and every description of solid refuse there produced which is capable of removal by suspension in water ; those communicating with the stables and cowhouses will receive the liquid refuse of the animals ; and those communicating with the roofed and paved surfaces will receive the surplus rainfall ; and the matter from all these sources will be quickly conveyed through them to the centre well.

At the centre well an overflow will be established into a pipe carried out to low water mark, through which the whole or any portion of the sewage-water may be discharged at will into the sea ; but in the event of the execution of works for the application of this valuable matter to its legitimate use, the enrichment of the soil, this overflow will only be used, to discharge that portion which must necessarily be wasted before its great value as a fertilizer becomes appreciated, and the full demand for it shall have arisen ; or during times of extraordinary flood ; or in case of accident to the lifting machinery.

During the execution of the works, and as the system progresses through each house or block of houses, the existing cesspools and ditches used for the reception of any description of house-drainage, will be emptied of their present contents and filled up with earth and entirely abolished ; no receptacle or channel of any kind being left for such matter, other than those offered by the new system.

The data before me for forming an estimate of the cost of these works of surface and refuse-drainage are even more imperfect than those I possess for estimating the cost of the works for the supply of water ; but the same motive which induced me to state a specific sum in that case, determines me to do the like in this, upon the understanding also that it is to be regarded as an approximation only. I have come to the conclusion that the whole of the works of refuse and surface-drainage, viz., the centre well and the system of pipes and their communications, (including the minimum accommodation of a stoneware water-closet pan and sink to each house,) the emptying and filling up of the present cesspools, and of those ditches now serving as receptacles for fæcal matter, may be effected for a sum not exceeding 3,500*l*.

Upon this estimate the annual expenses of the system will be as follows :—

level, say 4 feet from the surface, and that they might afford some amount of temporary storage room for storm waters. A few subsidiary lines will branch out of the main lines into the flat.

These water-courses will receive the whole of the surface water brought down from the uplands, and all that discharged by the agricultural drains in the flat; and they will have self-acting communications with the sea, so that at low states of the tide, their surplus water may be naturally discharged, and also with the centre well, in order that at or near high tide, the power of the steam-engine may be employed to lift the accumulation of heavy storms above the sea level for discharge, and thus preserve the proper level of the water.

I propose to fill up and entirely abolish all the existing ditches in the marshes, not required for the future water-courses; and to adopt other means for separating the fields, and for supplying the cattle with water.

That portion of the system intended to effect the removal of the free water from the soil of the flat, will consist simply of the common agricultural drains, for the action of which the works of surface drainage, by lowering the level of the water-courses, will have prepared the way.

For these drains I propose to adopt tubes 2 inches in diameter, and the lines will be laid at depths and at distances apart, to be hereafter determined upon a careful examination of the soil.

The outfalls will in nearly all cases be into the open water-courses, but some of the drains within the town, will have direct communications with the centre well.

The extent of the flat to be thorough drained, amounts to about 120 acres.

I am of opinion that these works of surface and subsoil drainage may be effected for a sum not exceeding 1200*l*.

The annual instalment of principal and interest upon this sum, would be provided by rates upon the property receiving benefit from the works, proportioned in each case to the amount of such benefit.

THE WORKS FOR THE APPLICATION OF THE SEWAGE WATER TO THE SOIL.—The works intended to effect the application of the refuse, will consist first of certain storage reservoirs, which may be conveniently placed at or near the point C; secondly, of a feeding pipe communicating with them from the centre well A; and thirdly, of certain lines of distributory pipes, leading from the reservoirs to the channels of irrigation in the meadows of the flat, which, by being thorough drained, will have been prepared to receive the liquid manure.

The reservoirs will be placed at a level of about 20 feet above the surface of the flat; they will be so formed and situated, that

any one reservoir may be emptied, or their number or dimensions increased when desired.

The feeding-pipe will be of stoneware or earthenware, and laid at a depth of about 3 feet beneath the surface. Its section will be large enough to allow the passage of the whole of the liquid refuse of the town, and for this the calculation will probably show that a diameter of 6 inches will suffice.

The distributory pipes will also be of stoneware or earthenware, and laid at a depth of about 3 feet, their size will be graduated, the dimensions of each line being calculated upon the area of land to be irrigated, and they will probably vary from 2 inches to 6 inches in diameter. Their communications with the channels of irrigation, will be so arranged, that any particular field may be irrigated at pleasure.

The power employed will be derived from the engine of the water works establishment at A.

I do not consider it necessary here to enter upon the question of the quantity of sewage water to be applied to a given extent of this land, in order to obtain the best results, This would soon be determined by actual experience. There can be no doubt, however, that the whole quantity of sewage water produced by the town, will be far more than sufficient for the irrigation of all the meadow land comprised within the district, including not only that of the flat, but of the lower portion of the uplands, skirting the marshes; I have therefore so placed the reservoir, that the system of distributory pipes may be extended over a portion of the immense flat lying to the west, and which commences in Seasalter parish, and thus ample field be provided for its full application.

The drainage of this further portion of land may be effected too, by establishing a communication between it and the centre well at A.

I have adopted a series of separate storage reservoirs, in order that the accumulated deposit of any individual one, may be periodically cast out and desiccated, and applied to the land, as manure, in that form when more desirable.

With regard to the cost of these works, I am not in a condition to state any specific sum that would meet it, but their execution at all, implies that they should be at least self-paying. With respect to them, however, I may state my confident opinion, that from the sale of the sewage water, which may be effected by their means, not only will this be the case, but that in the course of a few years after they are completed, when the value of this fertilizing matter shall be fully appreciated, the expenses of the works of refuse drainage, may, in a great measure, if not entirely, be defrayed from the income they will produce.

RECAPITULATION AND CONCLUSIONS AS TO REMEDIES.

1. That the present state of the town is such as to warrant the application to it of the provisions of the Public Health Act; and that in addition to the powers therein contained, special powers be taken to effect the drainage of the flat suburban district.

2. That the boundaries of the district which may be most advantageously adopted for the purposes of the Act, are not those at present existing, but those described upon the accompanying plan, and identical with the watershed-line of the hills embracing the town.

3. That the local Board of Health would be best adapted to the circumstances of the place if composed of six members.

4 That works for the general supply of water to the town, and capable of giving an unlimited supply of pure soft water, suitable for all domestic purposes, to every house, may be executed at a rate of charge of $1\frac{1}{2}d.$ weekly upon a house of the annual rental of $5l.$; of $2\frac{1}{2}d.$ weekly upon a house of the annual rental of $10l.$, and so in proportion; and that these charges would be in diminution, or in place, of existing charges of as great or greater amount.

5. That works for the refuse and surface drainage of the town, and which would provide for the instant removal from it of every description of liquid refuse, of all the solid refuse (including the excrementitious matter) capable of removal by suspension in water, and of the surplus rain-water, may be executed at a rate of charge of $1\frac{1}{4}d.$ weekly upon a house not exceeding the annual rental of $5l.$; and of less than $2d.$ weekly upon a house not exceeding the annual rental of $10l.$, and so in proportion; and that these charges would not only be in diminution of existing charges of much greater amount, but may themselves be in a great measure, or entirely, reduced by the proceeds of other works which have been described.

6. That works for the surface and subsoil drainage of the flat portion of the district, and which would provide for the discharge of the flood water, and of the free water of the soil may be executed; and this cost defrayed by a rate of very moderate amount upon the property benefited by them.

7. That works for the application of the sewage water to the soil would, notwithstanding, be self-paying, and would ultimately become the source of a considerable income to the town.

T. W. RAMMELL.

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